

NIOSH PPT Research to Support Strategic Goal #1: Reduce Exposure to Inhalation Hazards

Heinz Ahlers

Technology Evaluation Branch Chief

Jonathan Szalajda

Policy and Standards Development Branch Chief

March 6, 2008



NIOSH PPT Strategic Goal # 1

Program Objectives

1. **Ensure the integrity of the national inventory of respirators through the implementation of a just-in-time certification process (Poster Session)**
2. **Develop CBRN Respirator Standards to reduce exposure to CBRN Threats (Poster Session)**
3. **Ensure the Availability of Mine Escape Respirators for escape from mines**
4. **Improve reliability and level of protection by developing criteria that influence PPE designs to better fit the range of facial dimensions of respirator users in the U.S. workforce (Poster Session)**
5. **Quantify the impacts of various PPE on viral transmission (Poster Session)**
6. **Evaluate the nanofiber-based fabrics and NIOSH-certified respirators for respiratory protection against nanoparticles (Poster Session)**
7. **Develop and make available end-of service life indicator (ESLI) technologies that reliably sense or model performance to ensure respirator users receive effective respiratory protection (Poster Session)**
8. **Gather information on the use of respirators in the workplace to identify research, intervention, and outreach needs**

Organization/Staffing/Funding

- **This strategic goal supported by multiple divisions & locations within NIOSH**
- **NPPTL is the lead division for this strategic goal**
 - NPPTL has inhalation related research projects in each of its three branches
- **PPT portfolio includes ~ 45 Inhalation projects**

Reduce Exposure to Inhalation Hazards

Objective 1

Ensure the integrity of the national inventory of respirators through the implementation of a just-in-time respirator certification program

Technology Evaluation Branch

- **Respirator Certification Program**
- **Post Certification Programs**

Respirator Certification Program



**More than 8500 approvals
issued**

**90 manufacturers
102 manufacturing sites
18 countries**

**US, Australia, Brazil, Canada, Chile, China, Denmark, England, Finland,
Germany, Italy, Japan, Korea, Mexico, New Zealand, Taiwan, Thailand, Sweden**

Overall Performance

- **430 applications processed in FY2007**
 - 355 APR @ 70 day average
 - 75 ASR @ 77 day average
- **Roughly 80% of applications processed in less than 90 days.**
- **We are improving times in more complex test areas**
 - Focus on PAPRs and multi gas canisters in FY 08

Comparison of Particulate Approval Times for New Applications

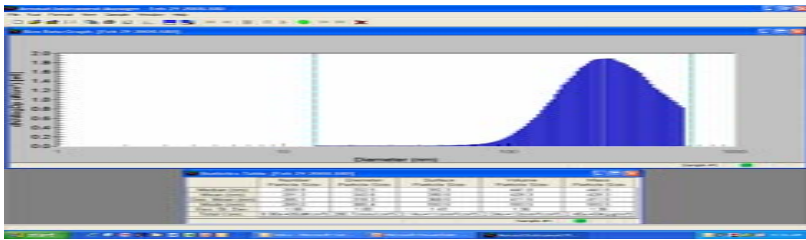
Fiscal Year	Number of New APR particulate applications	Average Time Days
2005	45	72
2006	88	61
2007	135	56

Post Approval Programs

- **Manufacturer Site Auditing**
- **Certified Product Auditing**
- **Certified Product Investigation Program**
- **Firefighter SCBA evaluation lab**
 - Coordination with the Division of Safety Research
- **Long Term Field Evaluation**

Laboratory Respiratory Protection Level (LRPL) Facility

Objective: To determine how well a properly fitted respirator fits persons with various facial shapes and sizes as specified by the LANL panel. The respirator design must maintain a fit during a series of exercises as part of a CBRN evaluation for NIOSH certification.



Particle generation by two MSP Corp High Output Aerosol Generators, 30 to 40 mg/m^3 and 400 to 600 nm Mass Median Aerodynamic Diameter (MMAD)



One 8587A Rear Light Scanning Laser Photometer per person monitors both inside and outside concentration



Reduce Exposure to Inhalation Hazards

Objective 2

**Develop Chemical Biological
Radiological and Nuclear (CBRN)
respirator standards to reduce
exposure to CBRN threats**

CBRN Respirator Standards Development

Standards Completed:

- **SCBA – January 2002**
- **SCBA upgrades – March 2003**
- **Gas masks (APR) –March 2003**
- **Escape sets – October 2003**
- **PAPR – October 2006**

Future CBRN Respirator Standards (SAR, CC-SCBA, Combination Units) will be incorporated as performance requirements through rulemaking updates to 42 CFR Part 84

CBRN Respirator Standards Development

Outputs:

Multiple CBRN Respirator Approvals and Multiple Manufacturers for each type of CBRN respirator

Outcomes:

- **DHS Adoption of NIOSH CBRN respirator standards**
- **IAB Adoption of NIOSH CBRN respirator standards**
- **NFPA adoption of NIOSH CBRN respirator standards**
- **BSI adoption of NIOSH CBRN Test Criteria**
- **Increase in the national inventory of CBRN respirators**

CBRN Respirator Standards User Guidance

Objective is to develop user guidance documents for:

- **CBRN respirators**
- **PPE Applications**
- **Respirator Use and Selection**

Planned Outputs (2008)

- **CBRN SCBA User Guide**
- **CBRN SCBA Training Aid Pamphlet**

Outcomes

- **Improve skills, knowledge, and abilities of user community**
- **Improved user safety and health**

Reduce Exposure to Inhalation Hazards

Objective 3

**Ensure the availability of Mine
Emergency Respirators for escape
from mines**

Mine Escape Respirator Topics

- **Closed Circuit Escape Respirator (CCER)**
- **Long Term Field Evaluation (LTFE)**
- **Closed Circuit Escape Workshops**
- **Dockable / Hybrid Escape Respirator**
- **Mine Refuge Chambers**

New CCER / SCSR Certification Standard

- Description
- Applicability to new and previously approved CCERs
- Required components, attributes, and instructions
- General testing conditions and performance concepts
- Capacity tests
- Performance tests
- Wearability tests
- Environmental treatments
- Additional testing
- Post-certification testing
- Voluntary Registration



Timeline

Public Meetings – Initial Concepts

- **April 10, 2003 – Arlington, VA**
- **April 24, 2003 – Golden, CO**

Reviewed with MSHA

Staff Level Preparations for Rulemaking

Public Meetings – Concept Requirements

- **September 19, 2006 – Arlington, VA**
- **September 28, 2006 – Golden, CO**

Comments Reviewed / Reconciled → March '07

Closed-Circuit Escape Respirators (CCER) Module

- **Rulemaking Process Resumed → April 2007**
- **Notice for Proposed Rulemaking (NPRM)
proceeding through Approval Process**
- **NPRM will be published in the Federal Register**

Long-Term Field Evaluation (LTFE)

- **Product auditing program to determine how well SCSRs endure the underground coal mining environment**
- **Results from multiple phases of testing indicate that SCSRs experience some performance degradation**
- **Suspected problems and nonconformities are reported for investigation under the CPIP**
- **Redesign LTFE Implemented 2Q FY 2008**

Long Term Field Evaluation (LTFE) Program

- **Initiated >20 years ago by U.S. Bureau of Mines**
- **Laboratory test to evaluate SCSR ability to withstand rigors of mine environment**
- **Developed in collaboration with industry, labor & other stakeholders**
- **LTFE impact → improvement for**
 - Chemical bed retention/integrity
 - Breathing hose material
 - Component packaging
 - Inspection

Redesign LTFE Program

Objective:

- **identify random based sampling plan**
- **document evaluation procedures**
- **define evaluation criteria**
- **define evaluation follow through action process**
- **identify reporting requirements.**

Follow Through Actions

- **LTFE Critical Parameters:**
 - **No failures allowed**
 - **Follow through action in the event of failure**
 - + **100% immediate corrective action to**
 - + **fix & recall, or**
 - + **rescind approval, and notify users**
- **Follow through actions processed via Certified Product Investigation Program (CPIP)**

LTFE Reports

- **Initial Inspection Report**
- **Initial Failure Report**
- **Annual Report**
 - All SCSRs tested during calendar year

Workshops on Self-Contained Self-Rescue Breathing Systems

- **Collaboration with National Technology Transfer Center (NTTC)**
- **Series of workshops**
 - Two workshops during 2005 (June & December)
 - One workshop July 2006
 - Two Workshops February & March 2008
- **Innovative and creative technology for closed circuit escape respirators (CCER)**
 - Listen, learn, share and apply

Closed Circuit Escape Respirator (CCER) Technology

Innovative and creative technology for:

- Oxygen generation
- Carbon dioxide removal
- Carbon monoxide elimination
- Materials for respirator components
- Materials for storing chemicals and high pressure gasses
- Test technology
- Training methods and materials
- Service and maintenance

Closed Circuit Escape Respirator (CCER) Technology

Application of innovative and creative technology to:

- **Provide respiratory protection with increased capacity (duration)**
- **Reduce physiological burden of escape respirators**
- **Improve ruggedness and durability of escape respirators**
- **Improve the capability to provide realistic training**

Notes from previous workshops located at:

<http://www.nttc.edu/clients/niosh/workshopnotes.asp>

Dockable and Hybrid SCSR Contract

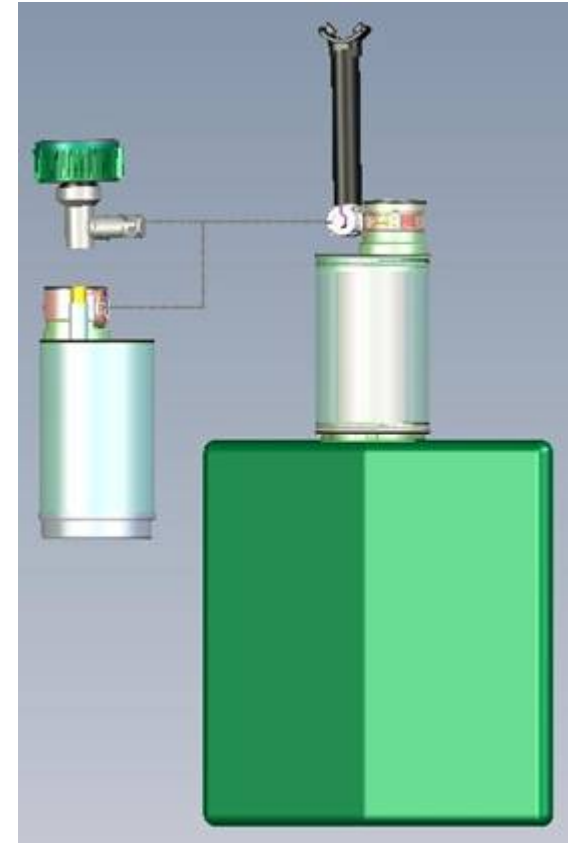
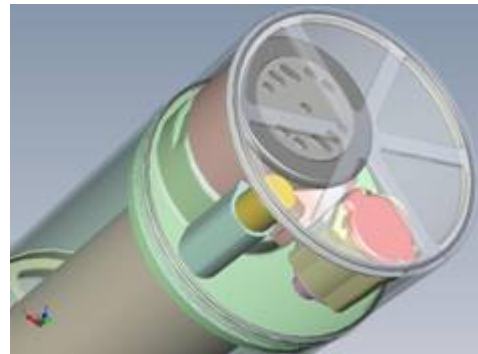
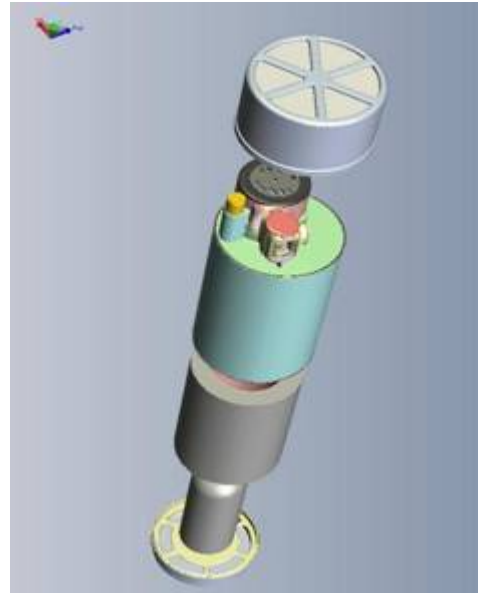
Objective –

Develop and evaluate a Person Wearable Dockable and Hybrid Self-Contain Self-Rescuer (SCSR) that will meet the requirements of 42 CFR Part 84



Dockable / Hybrid Respirator Concept

- SCSR is stored/ housed in sealed belt mounted container
- When needed user opens container and deploys breathing hose
- Counterlung automatically inflates
- O2 flow regulated automatically
- When rebreather is spent SCSR connects to an available breathing air supply



Mine Refuge Chambers for Underground Coal Mines

- Engineering simulation testing was conducted on 4 chambers.
- Research goals were to investigate:
 - CO₂ Levels
 - Oxygen flow rates
 - Heat index during chamber operation
 - Overall deployment and operation of the chambers
- Research report prepared and posted on Mining Program website

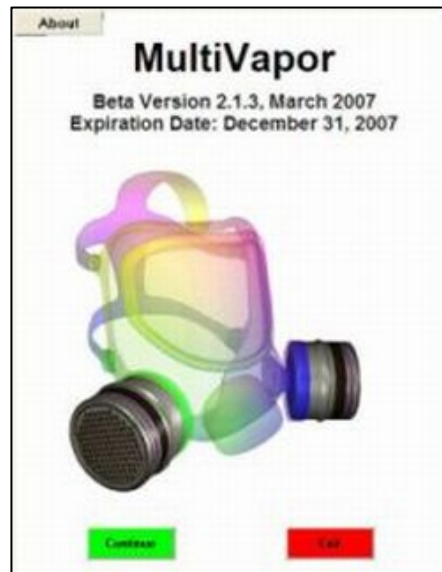
Reduce Exposure to Inhalation Hazards

Objective 7

Develop and make available end-of-service life indicator (ESLI) technologies that reliably sense or model performance to ensure respirator users receive effective respiratory protection

ESLI & Electronics Research

- **Develop/Integrate Chemical Sensors for Real-Time Determination of Respirator Cartridge Service Life**
- **Respirator Cartridge End-of-Service Life Modeling**



Reduce Exposures to Inhalation Hazards

- **Tactical Approach: Develop Standards for personal respiratory equipment**
- **Modular Approach to Rulemaking**

Develop Standards for Personal Respiratory Equipment

- **Develop conceptual requirements**
 - Technical concept
 - Website posting
 - Public & Stakeholder meetings
 - Docket
- **Finalize criteria and standard test procedures for certification**
- **Finalize the preamble and comply with all federal requirements**
- **Submit to the Federal Register “Notice of Proposed Rulemaking”**
- **Hold additional public meetings as information exchange meetings**
- **Rulemaking records, submitted comments, scientific reports, test data and related information will be publicly accessible through the NIOSH website**
- **Publish a final rule in the Federal Register**
 - Contains all regulatory text
 - Includes responses to public meetings and docket comments
 - Explains changes from the proposed rule to the final rule and the rationale

Develop Standards for Personal Respiratory Equipment

Notices for Proposed Rulemaking (NPRM) in Agency Review

- **Quality Assurance Module**
- **Closed Circuit Escape Respirator**

Concepts Completing Development in 2008 (Posters)

- **Total Inward Leakage for FFR and half masks**
- **Powered Air-Purifying Respirators**

Concepts in Development (Posters)

- **Closed Circuit SCBA**
- **Supplied Air Respirators**

PPT Approach is to develop two NPRM each year

Total Inward Leakage Program Status

- **Reviewing docket comments**
- **Finalizing performance criteria and standard test procedures for certification based on docket comments**
- **Developing the preamble**
- **Preparing NPRM submittal for Agency Review in mid-2008**

Summary

- **PPT Program is conducting a wide range of projects that address the reduction of inhalation hazards strategic goal and its objectives**
- **The PPT program is working the tactical approach to develop personal protective standards through updates to 42CFR Part 84, as well as through national and international standards**